

## Science with the James Webb Space Telescope

Jonathan P. Gardner

### Biography:

Jonathan P. Gardner is the Chief of the Laboratory for Observational Cosmology at NASA's Goddard Space Flight Center and the Deputy Senior Project Scientist for the James Webb Space Telescope.

### Abstract:

The science objectives of the James Webb Space Telescope fall into four themes. The End of the Dark Ages: First Light and Reionization theme seeks to identify the first luminous sources to form and to determine the ionization history of the universe. The Assembly of Galaxies theme seeks to determine how galaxies and the dark matter, gas, stars, metals, morphological structures, and black holes within them evolved from the epoch of reionization to the present. The Birth of Stars and Protoplanetary Systems theme seeks to unravel the birth and early evolution of stars, from infall onto dust-enshrouded protostars, to the genesis of planetary systems. The Planetary Systems and the Origins of Life theme seeks to determine the physical and chemical properties of planetary systems around nearby stars and of our own, and to investigate the potential for life in those systems. These four science themes were used to establish the design requirements for the observatory and instrumentation. Since Webb's capabilities are unique, those science themes will remain relevant through launch and operations and goals contained within these themes will continue to guide the design and implementation choices for the mission. More recently, it has also become clear that Webb will make major contributions to other areas of research, including dark energy, dark matter, active galactic nuclei, stellar populations, exoplanet characterization and Solar System objects. In this paper, we review the original four science themes and discuss how the scientific output of Webb will extend to these new areas of research.

### Brief Abstract:

The James Webb Space Telescope was designed to meet science objectives in four themes: The End of the Dark Ages: First Light and Reionization, The Assembly of Galaxies, The Birth of Stars and Protoplanetary Systems, and Planetary Systems and the Origins of Life. More recently, it has become clear that Webb will also make major contributions to studies of dark energy, dark matter, active galactic nuclei, stellar populations, exoplanet characterization and Solar System objects. We review the original four science themes and discuss how the scientific output of Webb will extend to these new areas of research.